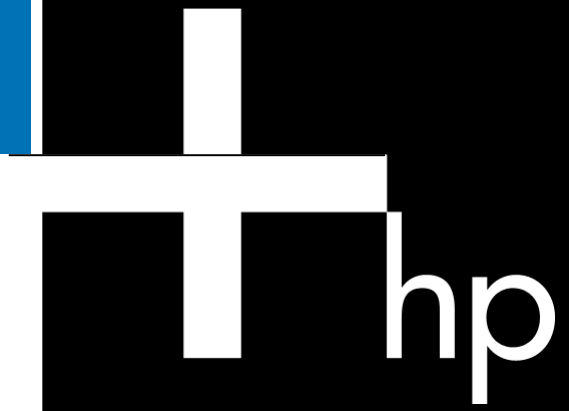
Deploying Linux/ia64 in the Telecommunications Market



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Agenda

- Why is Linux interesting in telco
- Telco applications
- Typical telco requirements
- Linux/ia64 features
- kexec
- Error Management and Recovery
- Reserved Memory support
- Field deployment experience

Why the Interest in Linux in Telco?

- Moving from custom hardware to off-the-shelf
- Value line has moved above OS and OS is not a core competency for telco
- Avoid vendor lock in
- Open source
- Open development environment
- Robust code

Telco Applications

- Traditional telephony:
  - Base Station Controller
  - Mobility Management
  - Push-To-Talk
  - Home Location Register
  - Core Switch
- Next Generation Networks:
  - IP Multimedia System
  - Session Border Controller
  - Cacheing Servers
  - Media Gateways

Typical Requirements

- High reliability: five or six 9's, Fast bootup/reboot
- Manageability: Error reporting and recovery, IPMI, Process accounting, Memory and page fault management
- Standards compliance: POSIX 1003.1b, Networking RFCs
- Networking: SCTP, IPv6, Bonding
- Performance: Bounded latency, Network throughput, Failover times
- Development: Trace tools, Kernel debugger

Linux/ia64 Features

- Robust 64-bit NEBS-3 compliant platofrm
- Error handling – MCA and INIT
- Memory fault management in firmware on HP machines
- Variable page size
- SCTP and bonding
- kdb, kgdb and ALT-SysRq for kernel debugging
- HP implemented telco enhancements in a service offering called “Debian GNU/Linux with HP Telco Extensions”. Last released version 2.0 is based upon 2.6.10 kernel and Debian Sarge.

kexec

- Fast reboots by avoiding firmware execution:
  - Load another kernel with `kexec -l`
  - Upon reboot with `kexec -e`, current kernel shuts down, sets up execution environment for the next kernel and transfers control to the next kernel bypassing firmware execution
- kexec reboot on kernel panic
- kexec reboot on INIT
- Also required changes to EFI memory map handling
- kexec on ia64 in 2.6.20 kernel

Error Management and Recovery

- Single bit memory errors reported up through CMC
- SAL records for CMC, CPE, MCA and INIT
- IPMI support for sensor data
- Kernel crash dump
- Notifier list support on panic and MCA
- Simple panic driver

Reserved memory support

- Allows one to reserve a chunk of memory not used or managed by the kernel
- In conjunction with kexec reboots, this memory is preserved across reboots.
- A custom driver module manages this memory – allocation, deallocation
- Any page faults in this memory region are handed off to handler registered by the custom driver module
- Supports mapping pages with different sizes in this region using long VHPT format

Linux/ia64 Field Deployment

- In deployment for little over a year carrying live phone traffic
- No bugs reported so far in the core kernel
- By the end of 2007, 30% of world's cell phone traffic will be carried on Linux/ia64
- Initial successful deployment of Mobility Manager application and Push-to-Talk processors on 2.4 kernel transitioning to 2.6 kernel
- 3 year old deployments of Base Station Controllers on 2.4 kernel still running with zero bugs reported so far

Overall Observations

- Linux/ia64 has proven to be surprisingly robust platform in a very demanding environment
- Telco requirements drove features and code that benefit Linux in general – Simplified and more reliable EFI memory map handling, kexec on ia64, SCTP enhancements, LKCD improvements, many bug fixes during development and reliability testing.